

# **The Context for the MODIS Land Products**

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## **Improved Land Remote Sensing**

- **MODIS development**
  - **Heritage instruments: AVHRR (1981-present), Landsat**
  - **Will provide the next generation moderate resolution remote sensing of the land surface to complement Landsat 7, ASTER, MISR**
  - **Intended improvements for land remote sensing in the areas of**
    - **near daily coverage (AM/PM)**
    - **spatial resolution (250, 500m, 1km)**
    - **spectral coverage**
    - **calibration**
    - **geolocation (goal .1 @1km)**
  - **Build on data processing experience of Pathfinders**
  - **Prototype using 1km systems: AVHRR, SeaWIFS, ATSR, SPOT Vegetation**

## **MODLAND Approach**

- Small number of critical products
- Enhanced products building on existing capabilities (VI's, LAI/FPAR, land cover, fire, snow cover, NPP)
- Small number of new 'standard' products using new MODIS capabilities (surface reflectance, BRDF, land cover change, surface temperature)
- Prototyping using a variety of existing systems to cover spatial, temporal and spectral dimension
- 'Community algorithms' - responsive to ATBD reviews
- Explicit product QA and accuracy statements
- Explicit validation for each product

## **MODLAND Products**

- **Surface Reflectance**
- **Land Surface Temperature**
- **BRDF/Albedo**
- **Vegetation Indices**
- **Snow Cover and Sea Ice**
- **Land Cover**
- **Land Cover Change**
- **Fire**
- **LAI/FPAR**
- **NPP**

## **Research and Applications Context for MODLAND Products**

**MODIS Land Products will provide input to :**

- **The US Global Change Science Program (USGCRP)**
- **The NASA Remote Sensing Science R and D Program**
- **The NASA Satellite Applications Program**
- **The National/Regional Assessment Initiatives**
- **The FCCC and the Policy Arena**
- **National and International Long-term Land Monitoring /Observing Systems (GTOS/GCOS, SIT).**

# USGCRP

- **Main Focus Areas:**
  - **Seasonal to interannual climate fluctuations**
  - **Climate change over decades to centuries**
  - **Stratospheric ozone depletion, UV radiation, and atmospheric chemistry**
  - **Changes in land cover and in terrestrial and marine ecosystems.**
- **USGCRP: Our Changing Planet 1998**
  - The Earth Observing System (EOS) AM-1 satellite will provide near-daily global measurements of **indicators of photosynthetic processes, allowing determination of carbon uptake by the terrestrial biosphere.**
  - EOS AM-1 will measure the radiative properties of the atmosphere, enabling **estimates of the heating and cooling of the Earth** and atmosphere.

## USGCRP 1998

- **Interactions between terrestrial surfaces and the atmosphere** will be better defined in terms of the **transfer of energy, water vapor, and especially carbon dioxide**, as the **AmeriFlux** and **Grassland CO2** flux networks complete 2-3 years of measurements in forests and rangelands, providing critical information on the global carbon balance and providing modelers with better data sets.
- **Mapping Global Land Cover**--Development of the first global synthesis of information on land cover at a spatial resolution of 1 km (about 0.6 miles) was completed. These data are helping improve understanding of **land cover**, ocean productivity, and the **cycling of carbon** through the Earth system, thus contributing to **better predictions of climate change** on national and global scales.

## USGCRP 1998

- **Changes in Land Cover and in Terrestrial and Aquatic Ecosystems** --The USGCRP seeks to understand, predict, and assess the causes, magnitude, and consequences of changes in land cover and in terrestrial and aquatic ecosystems, and to strengthen the scientific basis for sustainable environmental and natural resource practices.
- **Observations, analyses, and modeling studies of the El Niño Southern Oscillation (ENSO)** will focus on understanding the cause- and-effect relationships between mid-latitude and tropical variability on decadal time scales, which is expected to contribute to improving ENSO predictability.

## **MODLAND Product Suites**

MODIS products map to USGCRP goals by product suite:

- **Energy Balance Product Suite: land /atmosphere interactions**
  - surface reflectance, surface temperature, BRDF/albedo, snow and ice cover
- **Vegetation Product Suite: productivity and biogeochemical cycle**
  - vegetation indices, LAI/FPAR, NPP
- **Land Cover Product Suite: carbon cycle / regional assessments /resource management and sustainability**
  - land cover, continuous fields, land cover change, fire products

# **MODLAND: the Way Forward**

- **July 15 1999 launch date**
- **Need updated schedules for :**
  - **instrument check out and 1A data availability**
  - **first order Post Launch instrument calibration and characterization plan (MCST)**
  - **geolocation, registration accuracy determination (SDST)**
  - **availability of land data sets (MODAPS)**
  - **1999 validation campaigns (MODLAND)**
  - **Sample product generation and distribution**
- **Goal to establish a stable data product record**
  - **coordinated reprocessing schedule**

# **MODLAND: the Way Forward**

- **Near-term Emphasis**
  - **Testing MODAPS**
  - **Testing the QA procedures and data access system**
  - **Complete algorithm prototyping activities -AVHRR, SeaWIFS**
  - **CMG's**
  - **Early science prototyping**
- **Outstanding Issues**
  - **Data continuity**
  - **Cross instrument linkages**
  - **Incorporating PM algorithms and data**
  - **Validation coordination**
  - **Early Science demonstration**
  - **MODLAND contribution to the Earth Observatory**
  - **ECS data archive and distribution**
  - **MODIS and Applications**

# Outstanding MODLAND Issues

- **Data Continuity**
  - **AVHRR < MODIS**
    - **need to establish the relationship of MODIS data to the AVHRR long term GAC record - overlapping 2 years of global 1km ( EDC DAAC) -**
  - **MODIS > NPP and NPOESS VIIRS**
    - **MODIS provides a test bed for the next generation ‘operational’ land products for NPOESS VIIRS**
    - **MODIS provides test bed for Vicarious Calibration, QA procedures and validation protocols and standards for ‘operational products’**
    - **relationship of MODIS products to planned future instruments products needs to be established for NPP and NPOESS VIIRS - means for transitioning research into operations**
  - **Long term archive arrangements ?**
- **MODIS AM/PM - develop algorithms / code for two satellite inputs**

# Outstanding MODLAND Issues

- **Cross Instrument Linkages (Landsat 7, ASTER, MISR, CERES)**
  - Arrangements for data acquisition
  - Arrangements for data transfer ?
  - Multisensor product generation ?
  - Validation coordination - EOS core sites (SWAMP)
- **MODIS Validation**
  - Coordination with Validation PI's, Bigfoot
  - Validation in a science context e.g. using regional campaigns
  - Emphasis on measurement protocols and accuracy
  - Focus on Core Sites for AM inst. data acquisition (SWAMP)
  - Promote easy access to Validation Data sets (DAAC's)
  - Need to move validation into international arena- GLI, MERIS
    - Engage CEOS Cal/Val in developing Global Test Sites (vicarious calibration and validation) and protocols

# **Outstanding MODLAND Issues**

- **Early Science Initiatives for MODLAND**
  - Focus on the major ‘community’ regional field programs
    - LBA, GCIP, SAFARI-2000
  - Strengthen linkages to the modeling community as data users
  - Contribute to CEOS Operational Pilot - Global Observation of Forest Cover
- **Earth Observatory**
  - need to develop the land product feed to the Earth Observatory
- **MODIS data production, reprocessing, distribution**
  - ECS dependencies, delivery dates and testing schedule
  - Acceptance tests must be end to end ie. sample users getting data
  - PI production limited (50/75/100) and frequency of reprocessing

# **Outstanding MODLAND Issues**

- **MODIS and the Applications Program**
  - **operational users mostly need stable and continuous data**
  - **continue discussions on possible applications /pilots**
  - **suggest a NASA AO on AM pilot applications end of 1999**
    - **enhance existing applications (overlap)**
    - **initiate new applications**
  - **suggest MODIS/AM applications workshops Spring 2000**